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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :  
JUN GAO, ET AL. : EXAMINER: SALVITTI, MICHAEL  
SERIAL NO: 10/566,248 :  
FILED: MAY 26, 2006 : GROUP ART UNIT: 1796  
FOR: METHOD FOR PRODUCING :  
AQUEOUS POLYMER DISPERSIONS

REPLY BRIEF

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

SIR:

The following is a reply to the Examiner's answer of January 22, 2010 to Appellants' appeal of September 30, 2009 of the Examiner's Rejections of April 1, 2009 of claims 1, 4-11, and 14-22 as obvious.

*(1) The rejection of Claims 1, 4-11, and 14-22 under 35 U.S.C. 103(a) over Costanza et al., US 4,003,871.*

(a) The Examiner maintains his theory that Costanza et al. describe heating the reaction mixture from the starting temperature  $T_S$  (e.g., 50°C) to the ending temperature  $T_E$  (up to 80°C or above) during polymerization in the reactor. See, e.g., page 4, last paragraph; page 5, second full paragraph; pages 10-11, paragraphs (A)(3)-(4); page 12, paragraph (C); and page 16, last paragraph, of the Examiner's Answer ("Answer"). The Examiner pointed to Example 3 and col. 7, ln. 3-8 of Costanza et al. for support.

The Examiner has committed reversible error for the following reasons:

(i) Costanza et al. describe that “[t]he polymerization temperature will generally range from about room temperature (i.e., ambient temperature) or lower to about 80 °C or above, and preferably from about 20 °C to about 60 °C. This temperature can be varied as the polymerization proceeds towards substantial completion.” In Example 3, the polymerization temperature is constant and is 50 °C during 2 hours of metering. Example 3 in col. 8, ln. 40-41. The reactor was further maintained at 50 °C for 10 hours. Example 3 in col. 8, ln. 41-42.

Thus, Costanza et al. describe that the polymerization temperature can be from room temperature or lower to about 80 °C or above, e.g., 50 °C as in Example 3. The polymerization temperature is constant as illustrated in Example 3 and also reiterated in col. 2, ln. 32-34, “[t]he reaction medium is *maintained* at a temperature which will *initiate and maintain* the polymerization reaction.” (emphasis added).

The room temperature, 50 °C, and 80 °C or above described by Costanza et al. is the temperature at which the polymerization reaction is initiated ( $T_S$ ). The end temperature ( $T_E$ ) is equal to  $T_S$  because the reaction medium is *maintained* at a temperature which will *initiate and maintain* the polymerization reaction. Col. 2, ln. 32-34. Thus, 50 °C and 80 °C are not starting and ending polymerization temperature, respectively; but each 50 °C and 80 °C are both starting and ending polymerization temperature. For example, 80 °C is  $T_S$  and  $T_E$ .

Although Costanza et al. generally describe that the polymerization temperature can be “varied” as the polymerization proceeds towards substantial completion, Costanza et al. do not describe, for example, whether the temperature is increased or decreased, and whether the reaction mixture is heated during metering of the mixture or after the metering, e.g., during the additional 10 hours (as in Example 3). As the mixture of Example 3 is held for 10 hours after metering, it is reasonable to interpret that “the substantial completion” period is beyond 2 hours of the metering of the pre-emulsion and is closer to the end of 10 hours when the metering has already been completed.

Costanza et al. do not suggest elevating the polymerization temperature from  $T_S$  50°C to  $T_E$  80°C or above, as asserted by the Examiner, not to mention, during metering the reaction mixture. Whether it is 50°C or 80°C, it is still the temperature at which the reaction is initiated and *maintained*. The polymerization temperature is not elevated.

In addition, the Examiner's arguments are contradictory because on page 5, second full paragraph and page 6, ln. 3, the Examiner has alleged that  $T_S$  is 50°C and  $T_E$  is 80°C or above, while on page 7, with respect to claim 10, the Examiner pointed out that the reaction mixture is held at 50°C for 10 hours. However, in claim 10, the reaction is held for 10 hours at  $T_E$ , not  $T_S$ .

Thus, the breadth of the disclosure coupled with the specific disclosure as to maintaining the polymerization temperature precludes any conclusion that Costanza et al. disclose or suggest elevating the polymerization temperature during metering the reaction mixture.

(ii) The Examiner has also alleged that one would have been motivated to raise the temperature during polymerization in Costanza et al. "with the motivation of increasing the speed of the reaction which will allow more product to be produced in a shorter period of time, resulting in cost and efficiency savings" (e.g., page 5, ln. 1-6; page 11, ln. 1-3; page 14, paragraph (1); page 16, ln. 3-6; and page 17, ln. 2-6, see Answer), "with the motivation of speeding the polymerization process, as a person skill in the art recognizes that higher temperature results in faster polymerization times" (e.g., page 5, ln. 1-6, see Answer), and "with the motivation of increasing the conversion of monomer" (page 19, first full paragraph, see Answer).

(1) These conclusions are merely the Examiner's assertions because the Examiner has not provided any evidence supporting his allegations.

There are many polymerization schemes that exist, each achieving a different goal, e.g., yield of polymers, different quality of polymers, purity, molecular weight, branching, etc., See, for example Costanza et al., col. 1. For example, increasing the speed of the reaction may not provide good purity of polymers.

Thus, the Examiner's collection of speculations fails to support a conclusion of obviousness. The rejection cannot be upheld because the Examiner's statements are merely unsupported allegations that are not based on objective evidence or acceptable scientific reasoning. The Federal Circuit has made it clear that obviousness rejections must be based on objective evidence of record. Cf. *In re Lee*, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002) (“ ‘The factual inquiry whether to combine references must be thorough and searching.’ ...It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with.”). For these reasons, the Examiner's rejection under 35 U.S.C. § 103(a) must be reversed.

(2) Further, a goal of Costanza et al. is to provide a stable aqueous polymer emulsion having low viscosity and a high content of solid, which is extremely difficult. Col. 1, ln. 5-47. Costanza et al.'s process provides the desired properties by using the mixed lyophilic and hydrophilic initiators. Col. 1, ln. 50-68. Also, “[t]he rate of addition of the pre-emulsion is controlled to provide essentially complete conversion of the monomers to a polymer as the pre-emulsion is added.” Col. 2, ln. 36-38. The presence of the Costanza et al. catalysts provides the substantially complete monomer conversion. Col. 6, ln. 28-33.

Thus, Costanza et al. control “the complete conversion” of monomers by using specific catalysts and by controlling the rate of the addition of the pre-emulsion. Costanza et al. do not suggest raising the polymerization temperature to increase conversion of monomers.

One may try to increase temperature during the polymerization. However, a skilled artisan would not have reasonably expected that raising the temperature would have improved or at least maintained the high solid content and low viscosity of the resultant polymer emulsion of Costanza et al. without actually conducting experiments.

Thus, the Examiner has not established a *prima facie* case of obviousness with respect to raising the temperature during metering the reaction mixture in Costanza et al. The Office has the initial burden of proof to establish the *prima facie* obviousness of the subject matter Applicants claim in view of the prior art teaching. *In re Fritch*, 972 F.2d 1260, 1265 (Fed. Cir. 1992); *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). Absent evidence which supports a rejection of the subject matter Applicants claim for obviousness, the Examiner's conclusion that Applicants' claims are unpatentable under 35 U.S.C. §103(a) must be withdrawn.

(iii) The Examiner has erred by asserting that a skilled artisan would have been motivated to elevate the temperature by 10°C during the polymerization because Costanza et al. teach elevating the temperature from 50 °C to 80 °C or above. Page 12, paragraph (C) of Answer.

The Examiner's speculation is unsupported. *In re Lee*, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002). As discussed earlier, in Costanza et al., the reaction medium is maintained at a temperature which initiates and maintains the reaction. Col. 2, ln. 32-34, and Example 3. Thus, each 50 °C and 80 °C is the starting temperature (50 °C or 80 °C) and the end point temperature (50 °C or 80 °C, respectively), i.e.,  $T_S = T_E$ . For example, when the reaction starts at 50 °C, the end temperature is also 50 °C, not 80 °C, as asserted by the Examiner. The broad disclosure that "the temperature can be varied as the polymerization proceeds towards substantial completion" does not describe or suggest elevating temperature by at least 10 °C because Costanza et al. expressly describe that the temperature is *maintained*

during the polymerization to achieve a high content of solid and low viscosity. Col. 2, ln. 32-34, and Example 3.

Also, as has been pointed above, one would not have reasonably expected that increasing the speed of the polymerization by raising a temperature would have provided a high solid content and low viscosity of a polymer without actually conducting experiments because changing the conditions of polymerization is known to change properties of the resultant polymers.

(b) The examiner has erred by interpreting the disclosure of Costanza et al., i.e., “[a] portion of the added pre-emulsion has been interpreted as being part of the initial charge.” Page 4, ln. 2-3 of Answer. Thus, the Examiner has artificially divided the metering of the pre-emulsion into two phases, an initial phase wherein the metering has just started corresponding to a1-a5 of claim 1, and the rest of the metering corresponding to c1-c5 of claim 1. However, the Examiner has used the claimed method as a roadmap which is an impermissible hindsight.

This interpretation is unreasonable because Costanza et al. specifically describe that the pre-emulsion is prepared (separately, not in the reactor) (col. 2, ln. 24-25), the reactor is filled with 0.5 parts of benzoyl peroxide (an oil soluble catalyst) and 20 parts of water (Example 3), and *then* the pre-emulsion is added to the polymerization reaction medium (metering into the reactor) (co. 2, ln. 24-25 and Example 3).

Thus, the initial charge of the reactor in Costanza et al. is composed of an oil soluble catalyst and water, wherein the pre-emulsion is metered thereafter. No dispersant is added to the initial charge, while in the claimed process, the initial charge comprises at least a oil-soluble initiator, water and a dispersant.

Moreover, when the artificial initial metering phase is interpreted as a1-a5 of claim 1, an amount of water in a1 is not equal or less than 50 wt.%, as asserted by the Examiner on

page 7 with regard to claim 16. When the reactor already comprises 20 parts of water (which is 50% of the total 40 parts, wherein 20 parts is in the reactor and 20 parts is in the pre-emulsion metered to the reactor), adding any amount of the pre-emulsion as the initial charge will add more water and the total water in the initial charge will be greater than 50 wt.%, while in claim 16, the amount of the initial water is 50% or less.

Thus, the Examiner's interpretation of the process of Costanza et al. raises a conflict and is unreasonable in view of the disclosure of Costanza et al.

*(2) The rejection of Claim 5 under 35 U.S.C. 103(a) over Costanza et al., US 4,003,871 and Gluck et al., US 5,908,872.*

(a) The Examiner has erred in concluding that one would have been motivated to modify the process of Costanza et al. with the elevated polymerization temperature of Gluck et al. because both references teach aqueous polymerizations with two catalysts and producing polymeric beads particles. Page 19, ln. 1-10 of Answer. The Examiner has also maintained his theory that suspension polymerization is similar to emulsion polymerization. Page 19, ln. 1-10 of Answer.

(i) The Examiner's assertion that the suspension polymerization is similar to the emulsion polymerization is incorrect. As explained in the Appeal Brief, the components, conditions, mechanisms, and resultant products are fundamentally different in the suspension polymerization and the emulsion polymerization.

In aqueous suspension polymerization, such as in Gluck et al., both initiators are oil-soluble. The aqueous suspension polymerization according to Gluck et al. proceeds in three steps. First, the oil-soluble initiators are dissolved into monomers and a monomers/initiators solution is formed. Second, the formed solution is dispersed in the aqueous phase and form small monomer droplets. Third, polymer particles are formed by polymerizing the small monomer droplets themselves. Thus, the polymeric particles have the same size as the

monomer droplets. There is no a micelle formation and a monomer migration through the aqueous phase from the large monomer droplets into the micelles to build up polymer particles, as in the emulsion polymerization.

In the emulsion polymerization according to the present invention, *first*, a dispersant, water and an oil-soluble initiator are mixed to solubilize the oil-soluble initiator in water and *then* monomers and a water soluble initiator can be added. More specifically, adding a dispersant to water creates micelles and also monomer droplets become 'emulsified' by the dispersant. If the dispersant is not used, the oil-soluble initiator would not be homogeneously dissolved into an aqueous phase during the polymerization. The oil-soluble initiator is at least partly dissolved into micelles (i.e., the oil-soluble initiator is enclosed into a micelle like in a cave) and the emulsion polymerization takes place in the micelles when monomers are added. During the polymerization, monomer molecules *migrate* from large emulsified monomer droplets *through the aqueous phase* into the micelles where the polymerization takes place. The oil-soluble initiator and growing polymeric chains are incorporated into the micelles to build up polymeric particles during the emulsion polymerization.

Thus, Gluck et al. and Costanza et al. use different catalyst systems and polymerization conditions, produce different polymeric particles, and mechanisms of the polymerization are fundamentally different.

(ii) One would not have been motivated to use the high temperature as in the Gluck et al. suspension (bulk) polymerization and also to elevate the polymerization temperature during metering of monomers in the Costanza et al. emulsion polymerization with a reasonable expectation of achieving high solid content and low viscosity of the Costanza et al. polymers because:

(1) a mechanism of the Gluck et al. suspension polymerization is fundamentally different from that of emulsion polymerization of Costanza et al. (e.g., the



behavior of the components, monomer droplets and polymerization particles; a size and a function of the monomer droplets and polymerization particles; a growing polymeric chain location; temperatures; and initiators),

(2) the Gluck et al. process comprises using only oil-soluble initiators, while in the Costanza et al. emulsion polymerization, both an oil-soluble initiator and a water soluble initiator are used, and

(3) in the Gluck et al. aqueous suspension polymerization, all monomer droplets are fed at the initial charge and monomers are not metered into a reactor while the polymerization temperature is increased, and different particles are formed compared to the particles of Costanza et al.

Further, one would not have reasonably expected that using temperatures adjusted for specific organic peroxides A and B for an aqueous suspension polymerization process would have successfully produced Costanza et al.'s polymer in emulsion which is obtained with different initiators (water and oil soluble), by a different process and a different temperature.

(iii) The Examiner's allegation that Applicants attacked references individually (page 20, ln. 1-14 of Answer) is incorrect because first Applicants explained the disclosures of the references and explained the differences between the suspension and emulsion polymerizations and then explained why combining the references would not have been obvious. Thus, Applicants addressed the combination of the references.

(iv) The Examiner has alleged that Applicants argued the limitations which were not in the claims, e.g., the limitations such as the micelle formation, dispersant, emulsion polymerization, etc. Page 13, ln 1-8 of Answer.

In response, it is noted that Applicants described mechanisms of suspension and emulsion polymerizations for the illustrative purpose only. The claimed method is directed to

a process of preparing an aqueous polymer dispersion by free radical *aqueous emulsion polymerization*. The mechanism of the emulsion polymerization is known.

However, the Examiner is able to fixate on two catalyst systems, "aqueous environment," and polymeric beads in general, yet ignore the fundamental differences of two polymerization processes of Costanza et al. and Gluck et al.

For these reasons, the Examiner's decision must be reversed.

Respectfully submitted,

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